A multi-server queueing inventory system with addressed retrials from a common orbit

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Abstract

Consider a customer interested in an item that is available in different brand names and at different locations. When he fails to get it from a shop in his first attempt, due to either shortage of the item or non-availability of the salesperson he moves to an orbit of infinite size and then retries later. Upon his retrial, he may choose another shop or an alternative/substitute item. When the time taken to serve the item is positive, we have a multi-server queueing inventory model with addressed retrials. Multi-server queueing model with addressed retrials has already been analyzed earlier [2]. The present work is an attempt to incorporate inventory into such a system. Primary arrival of customers is governed by a Marked Markovian Arrival Process(MMAP[K]) [1] and each node i has a single server with an inventory running according to (s_i, S_i) policy replenished in exponential lead times. When a customer approaches node i, if the server is free and inventory is available, he receives service in an exponential time with parameter μ_i. Otherwise, he moves to a common orbit of infinite size and retries with an exponential rate α and upon retrial, he chooses node i with a probability θ_i. The stability condition and steady-state probabilities of the system are obtained using matrix-analytic methods. Some important performance measures are also derived. A cost function is developed for optimal values of different system parameters and numerical illustrations are provided.

References

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